Paradise Creek TMDL

2015 Bacteria Addendum

Hydrologic Unit Code 17060108

Final

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October 2015

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Table of Contents

List of Tables

List of Figures

Abbreviations, Acronyms, and Symbols

§	section (usually a section of federal or state rules or statutes)
§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
AA basin	anaerobic conditioning basin
AB basin	aeration basin
AO basin	anoxic basin
AU	assessment unit
BMP	best management practice
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cfu	colony-forming unit
CGP	Construction General Permit
CW	cold water
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
EPA	United States Environmental Protection Agency
GIS	geographic information system
IDAPA	Refers to citations of Idaho administrative rules
LA	load allocation
LC	load capacity
m	meter
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer systems
MSGP	Multi-Sector General Permit
N/A	not applicable
NB	natural background
NPDES	National Pollutant Discharge Elimination System
PCEI	Palouse-Clearwater Environmental Institute
SCR	secondary contact recreation
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load
TSS	total suspended solids
USC	United States Code
USGS	United States Geological Survey
WAG	watershed advisory group
WLA	wasteload allocation
WWTP	wastewater treatment plant

Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the Paradise Creek watershed, which contains two assessment units (AUs) that have been placed in Category 4a of Idaho's most recent federally approved Integrated Report for *Escherichia coli* (*E. coli*) violations (DEQ 2014). Paradise Creek was previously listed as impaired for fecal coliform; *E. coli* is being updated as the pollutant due to a change in Idaho's water quality standards from criteria associated with fecal coliform to a more specific criterion for *E. coli*. Fecal coliform is not removed as a cause from the Integrated Report since it was the species of concern when Paradise Creek was initially listed. For more detailed information about the subbasin and previous TMDLs, see the *Paradise Creek TMDL: Water Body Assessment and Total Maximum Daily Load* (DEQ 1997).

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Paradise Creek watershed, located in northern Idaho. For more detailed information about the subbasin and previous TMDLs, see the *Paradise Creek TMDL: Water Body Assessment and Total Maximum Daily Load* (DEQ 1997).

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

Subbasin at a Glance

Paradise Creek is in the Palouse River subbasin (hydrologic unit code 17060108), which is located in northern Idaho bordering the state of Washington (Figure A). Paradise Creek is divided into three AUs, which are characterized by an upper headwaters section (ID17060108CL005_02b), a middle section characterized by agricultural use (ID17060108CL005_02a), and an urban section (ID17060108CL005_02). The headwaters of Paradise Creek are located on Moscow Mountain, with the creek flowing southwest for approximately 19 miles through agricultural land and then through the urban area of Moscow, Idaho, ultimately joining the South Fork Palouse River in Pullman, Washington. The Paradise

Creek watershed is 23,038 acres, with 13,888 acres located within Idaho and the other 9,150 acres in Washington. This addendum addresses the following AUs:

- Paradise Creek—urban boundary to Idaho/Washington border (ID17060108CL005_02)
- Paradise Creek—forest habitat boundary to urban boundary (ID17060108CL005_02a)

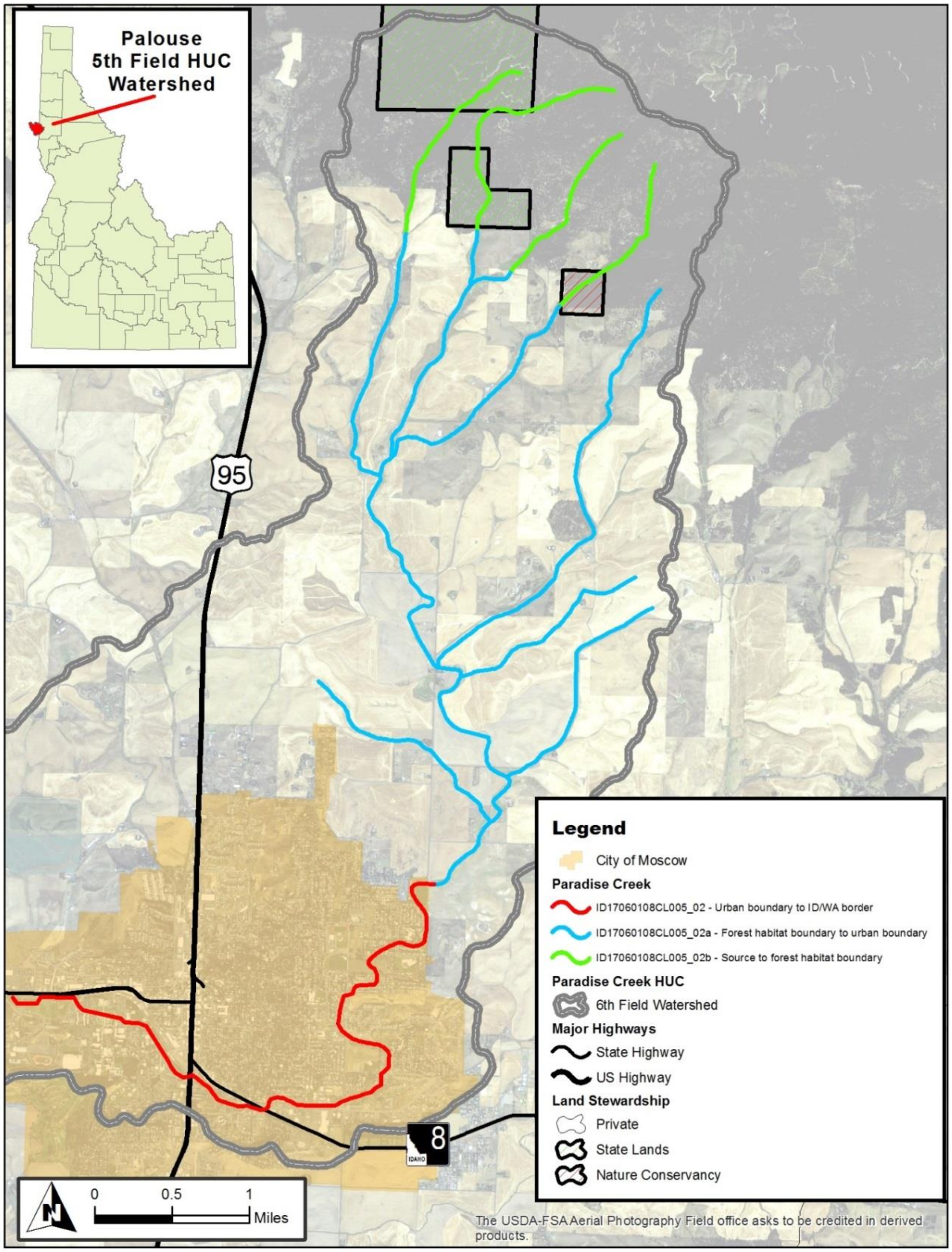

Figure A. Paradise Creek watershed.

The impaired beneficial use for Paradise Creek addressed in the addendum is secondary contact recreation. This addendum addresses one pollutant of concern, *E. coli* bacteria. Potential *E. coli* bacteria sources include waste from humans, pets, livestock, and wildlife.

Key Findings

Paradise Creek was placed on the 1994 §303(d) list of impaired waters, or subsequent lists, for reasons associated with bacteria criteria violations, and the Idaho Department of Environmental Quality (DEQ) has developed an *E. coli* bacteria TMDL for these waters to update the previous fecal coliform TMDL (Table A).

Effective *E. coli* bacteria targets for Paradise Creek were based on Idaho's water quality standards surface water quality criterion for recreation use designations of 126 colony-forming units per 100 milliliters of solution (cfu/100 mL) based on a minimum of five samples taken every 3–7 days over a 30-day period (IDAPA 58.01.02.251.01.a). Existing *E. coli* bacteria loads were determined from surface water sampling from May 2013 through April 2014. The *E. coli* target of 126 cfu/100 mL and existing *E. coli* levels were compared to determine the reduction needed to bring water bodies into compliance with the *E. coli* bacteria criterion. A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table B.

Table A. Water bodies and pollutants for which TMDLs were developed.

Water Body	Assessment Unit Number	Pollutant(s)
Paradise Creek—urban boundary to Idaho/Washington border	ID17060108CL005_02	*E. coli*
Paradise Creek—forest habitat boundary to urban boundary	ID17060108CL005_02a	*E. coli*

Table B. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Paradise Creek—urban boundary to Idaho/Washington border	ID17060108CL005_02	*E. coli*	Yes	No changes, currently in Category 4a	Update from fecal coliform to *E. coli* standard
Paradise Creek—forest habitat boundary to urban boundary	ID17060108CL005_02a	*E. coli*	Yes	No changes, currently in Category 4a	Update from fecal coliform to *E. coli* standard

Public Participation

The Paradise Creek Watershed Advisory Group, the Clearwater Basin Advisory Group, other agencies, nongovernment organizations, and the public played a role in the current and previous TMDL development processes, and their continued participation will be critical after the public comment period and in implementing the TMDL.

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Introduction

This document addresses certain water bodies in the Paradise Creek watershed that have been placed in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2014). The purpose of this total maximum daily load (TMDL) addendum is to document pollutant loads within the Paradise Creek watershed. The first portion of this document presents key characteristics and updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure the impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for the pollutant of concern. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges among the various sources discharging the pollutant.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure “swimmable and fishable” conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation’s waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation’s waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho’s water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a “§303(d) list”) of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho’s Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as “pollution.” TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Assessment—Subbasin Characterization

Paradise Creek is located in the Palouse River subbasin (hydrologic unit code 17060108) in the northwestern area of the state, bordering the state of Washington (Figure 1). There are three land use types in this watershed: headwaters, agricultural, and urban. Most of the land is privately owned. The headwaters of Paradise Creek are located on Moscow Mountain. The creek then flows southwest for approximately 19 miles, through agricultural land, and then through the urban area of Moscow, Idaho, ultimately joining the South Fork Palouse River in Pullman, Washington. The Paradise Creek watershed is 23,038 acres, with 13,888 acres located within Idaho and the rest in Washington. The upper portion of the watershed is steeply sloped, with the majority of the drainage basin consisting of moderately steep rolling hills. Elevations range from 4,356 feet at Paradise Point in the Palouse Range to 2,520 feet at the Idaho-Washington border.

Paradise Creek experiences intermittent flow in the upper stream reaches. Upstream from Moscow, Paradise Creek flows for several months from spring thaw until mid-summer when flows reach zero in many parts of the creek, reducing the stream to a series of small pools separated by stretches of dry creek bed. US Geological Survey (USGS) mapping shows Paradise Creek as perennial from Main Street (US Highway 95) downstream, with flow augmented by the City of Moscow Wastewater Treatment Plant (WWTP) before flowing into Washington.

Wetlands in the watershed are typically associated with the riparian areas along Paradise Creek and its tributaries, with natural vegetation being dominated by the introduced reed canary grass, in addition to native sedges, willows, and alders.

Moscow is home to approximately 24,500 people (US Census Bureau 2013), is the Latah County seat and cultural center, and is the site of the state’s land-grant university. The University of Idaho, agriculture, retail trade, and service industries are major contributors to the local economy. Most of the watershed is privately owned, with the predominant land use in the watershed being nonirrigated cropland, followed by urban land use.

For a more detailed description of climate, hydrology, geology, cultural characteristics, fisheries, and other characteristics of the Paradise Creek watershed, refer to the *Paradise Creek TMDL Water Body Assessment and Total Maximum Daily Load* (DEQ 1997).

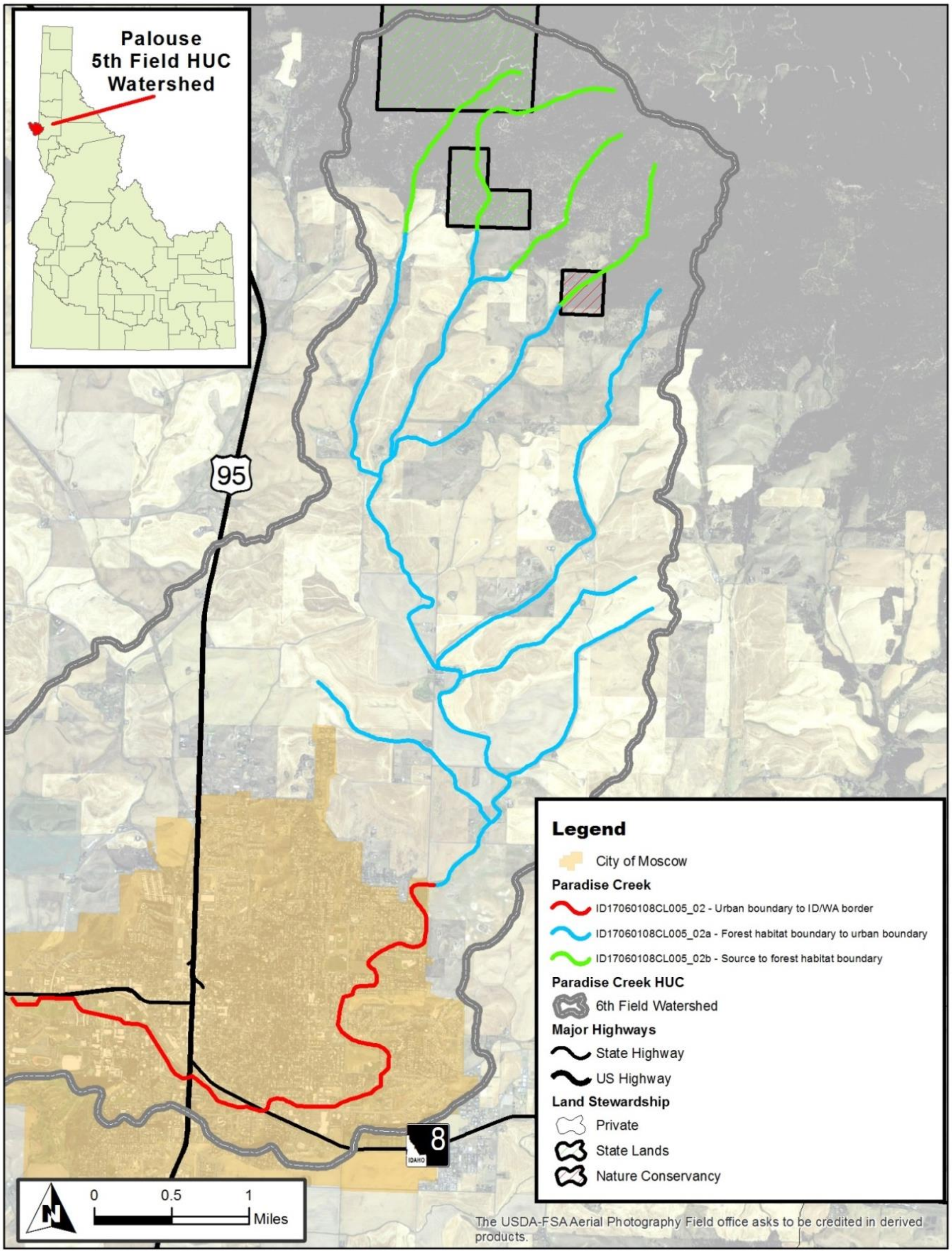

Figure 1. Paradise Creek watershed.

2 Subbasin Assessment—Water Quality Concerns and Status

Paradise Creek receives pollutants from several sources, including nonirrigated croplands, grazing lands, construction, urban runoff, roads, and timber harvest. In addition, Moscow's WWTP and the University of Idaho's aquaculture facility discharge to the creek through National Pollutant Discharge Elimination System (NPDES) permits.

TMDLs were developed for Paradise Creek in 1997 for all of the pollutants listed at the time except for flow and habitat alteration. EPA does not consider flow and habitat alteration to be pollutants as defined by the Clean Water Act. Since TMDLs are not required for water bodies impaired by *pollution* but not pollutants, TMDLs were not developed for flow or habitat alteration. However, flow and habitat alteration will be addressed through pollution control activities.

This document addresses two assessment units (AUs) in the Paradise Creek watershed that are in Category 4a of Idaho’s most recent federally approved Integrated Report for *Escherichia coli* (*E. coli*) bacteria impairment (DEQ 2014). The purpose of this TMDL addendum is to characterize and document *E. coli* pollutant loads within the Paradise Creek watershed.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

2.1.1 Assessment Units

AUs are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits, primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

2.1.2 Listed Waters

Table 1 shows the basis for listing for the AUs addressed in this addendum.

Table 1. Paradise Creek watershed assessment units addressed by this TMDL.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Paradise Creek—urban boundary to Idaho/Washington Border	ID17060108CL005_02	*E. coli*	1996 §303(d) list
Paradise Creek—forest habitat boundary to Urban boundary	ID17060108CL005_02a	*E. coli*	1996 §303(d) list

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes.

2.2.1 Existing Uses

Existing uses under the Clean Water Act are “those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards” (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

2.2.2 Designated Uses

Designated uses under the Clean Water Act are “those uses specified in water quality standards for each water body or segment, whether or not they are being attained” (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

2.2.3 Undesignated Surface Waters

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). These undesignated surface waters ultimately need to be designated for appropriate uses. In the interim, and absent information on existing uses, DEQ presumes most of these waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the cold water and recreation use criteria to undesignated waters. If in addition to *presumed uses*, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold water aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria.

2.2.4 Interstate Waters

Paradise Creek is an interstate water body flowing from Idaho state into Washington state. The Clean Water Act requires interstate waters meet downstream receiving water state standards when the water body crosses state lines. Idaho state has designated Paradise Creek for cold water aquatic life and contact recreation beneficial uses. These designated beneficial uses are considered to be comparable to the aquatic life and recreational beneficial uses designated by Washington state for Paradise Creek. Both Idaho and Washington states' water quality standards are approved by EPA for adequacy in protection of aquatic life and recreational beneficial uses. Pollutant TMDLs included in this document are anticipated to restore Paradise Creek to Idaho's water quality standards in Idaho and Washington state water quality standards when Paradise Creek crosses the state border and enters Washington.

2.2.5 Beneficial Uses in the Subbasin

Cold water aquatic life and secondary contact recreation are the designated beneficial uses of Paradise Creek (Table 2).

Table 2. Paradise Creek beneficial uses of applicable assessment units.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Paradise Creek—urban boundary to Idaho/Washington Border	ID17060108CL005_02	CW, SCR	Designated
Paradise Creek—forest habitat boundary to urban boundary	ID17060108CL005_02a	CW, SCR	Designated

[a] Cold water (CW), secondary contact recreation (SCR)

2.2.6 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 3). For additional information about water quality criteria, see Appendix A.

Table 3. Selected numeric criteria supportive of beneficial uses in Idaho water quality standards (IDAPA 58.01.02.240).

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Bacteria				
Geometric mean standard	<126 *E. coli*/100 mL[b]	<126 *E. coli*/100 mL	NA	NA
Single sample threshold	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	NA	NA

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily on biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 2).

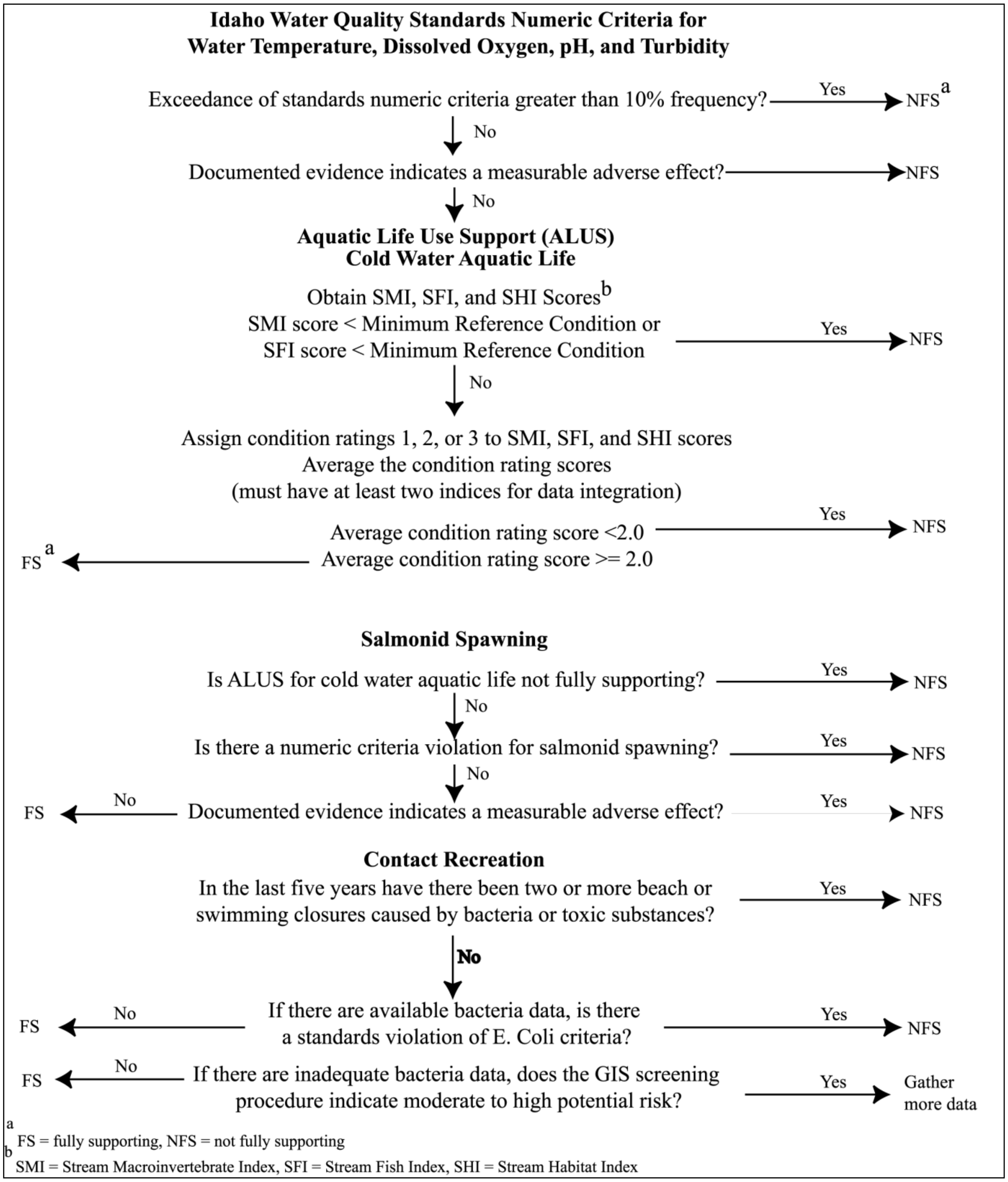

Figure 2. Steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 Summary and Analysis of Existing Water Quality Data

This section provides additional data collected since the Paradise Creek TMDL (DEQ 1997) was approved by EPA in 1998 that are pertinent to the bacteria impairments. Complete data are provided in Appendix B and Appendix C, with data sources listed in Appendix D.

A series of five samples taken every 3–7 days each month from May 2013 through April 2014 were used to calculate a monthly geometric mean for each month between May 2013 and April 2014. Samples were taken at the site on Perimeter Drive in AU ID17060108CL005_02. The July samples were not collected within the 3–7 day time frame and were not included in the monthly geometric mean calculations, but the data were included in the continuous geometric mean calculations. All 10 calculated monthly geometric means exceeded the 126 colony-forming units per 100 milliliters of solution (cfu/100 mL) criterion (Table 4; Figure 3). Figure 4 displays a continuous geometric mean to show the variation during different times of the year. Data are presented in their entirety in Appendix B. Figure 5 plots the monthly *E. coli* bacteria geometric means versus the discharge data collected by the USGS gage station at the monitoring site, while Figure 6 shows the monthly *E. coli* bacteria geometric means versus the monthly precipitation data for the Moscow, Idaho, area.

Table 4. *E. coli* bacteria concentration in Paradise Creek.

Date	Geometric Mean Concentration (cfu/100 mL)[a]
May 2013	688.1
June 2013	1192.0
August/September 2013	485.7
October 2013	437.0
November 2013	209.3
December 2013	785.1
January 2014	200.2
February 2014	167.9
March 2014	149.6
April 2014	185.1

[a] Colony-forming units per 100 milliliters of solution

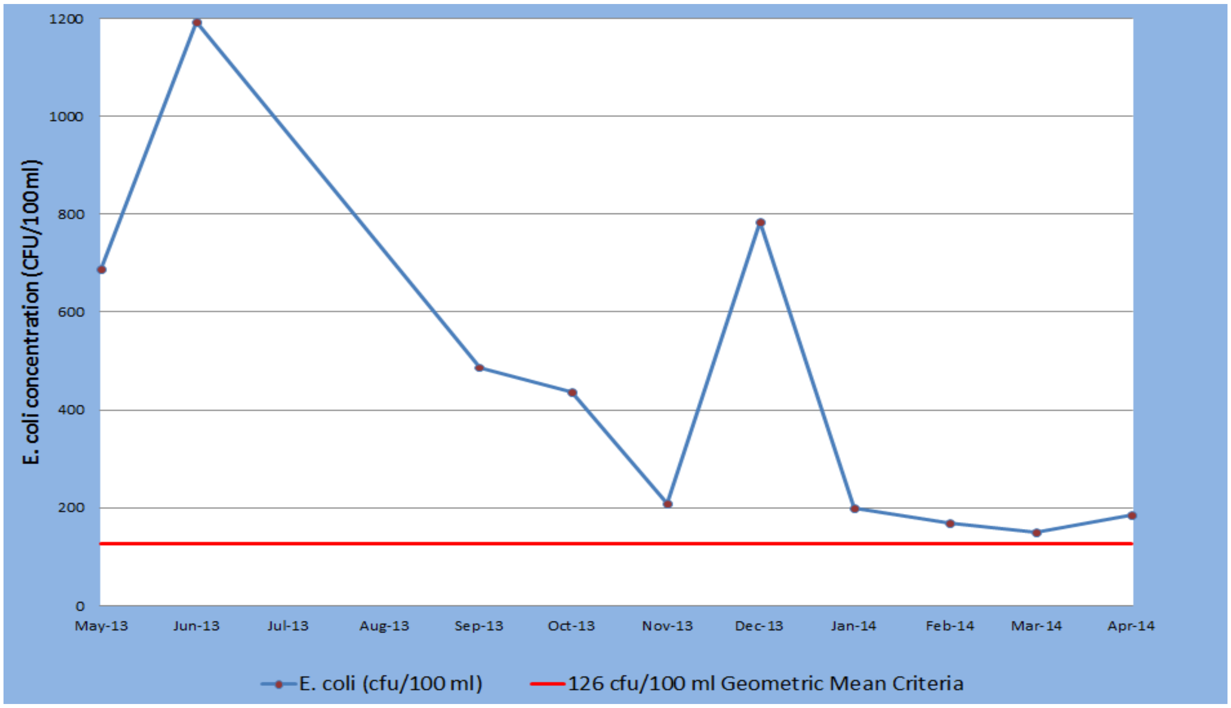

Figure 3. *E. coli* bacteria monthly geometric mean concentrations at Paradise Creek monitoring site (May 2013–April 2014).

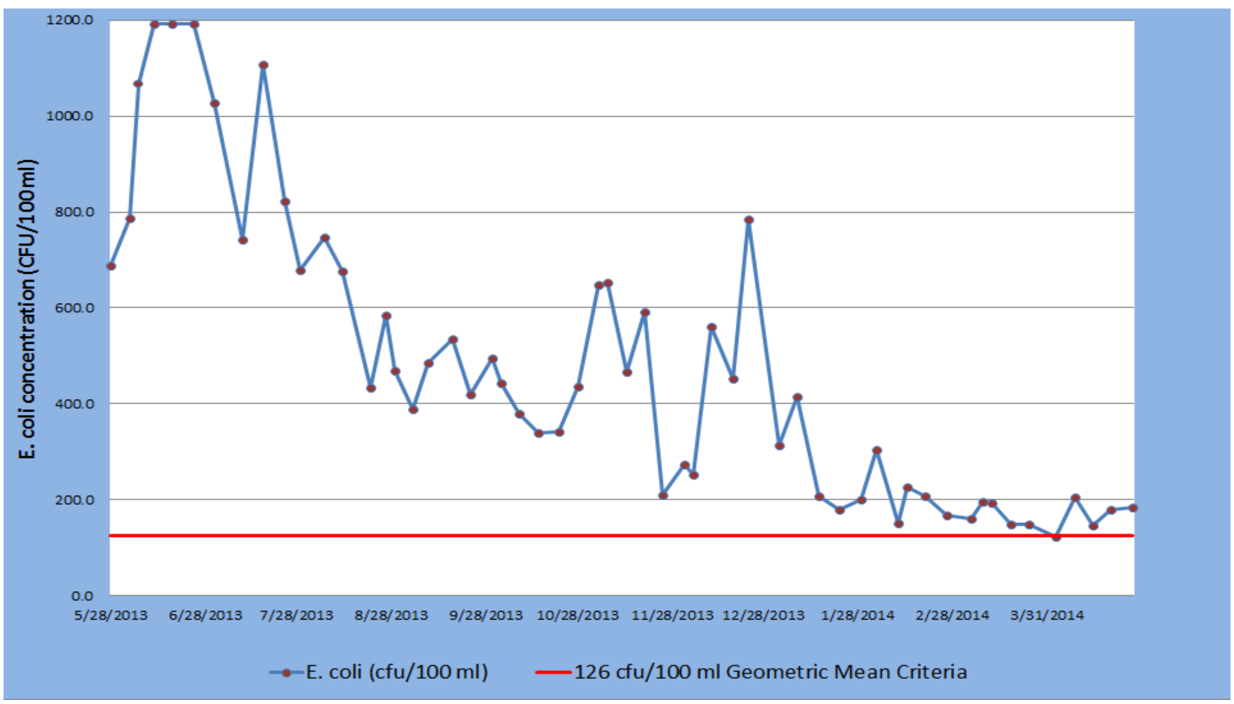

Figure 4. *E. coli* bacteria continuous geometric mean concentrations at Paradise Creek monitoring site (May 2013–April 2014).

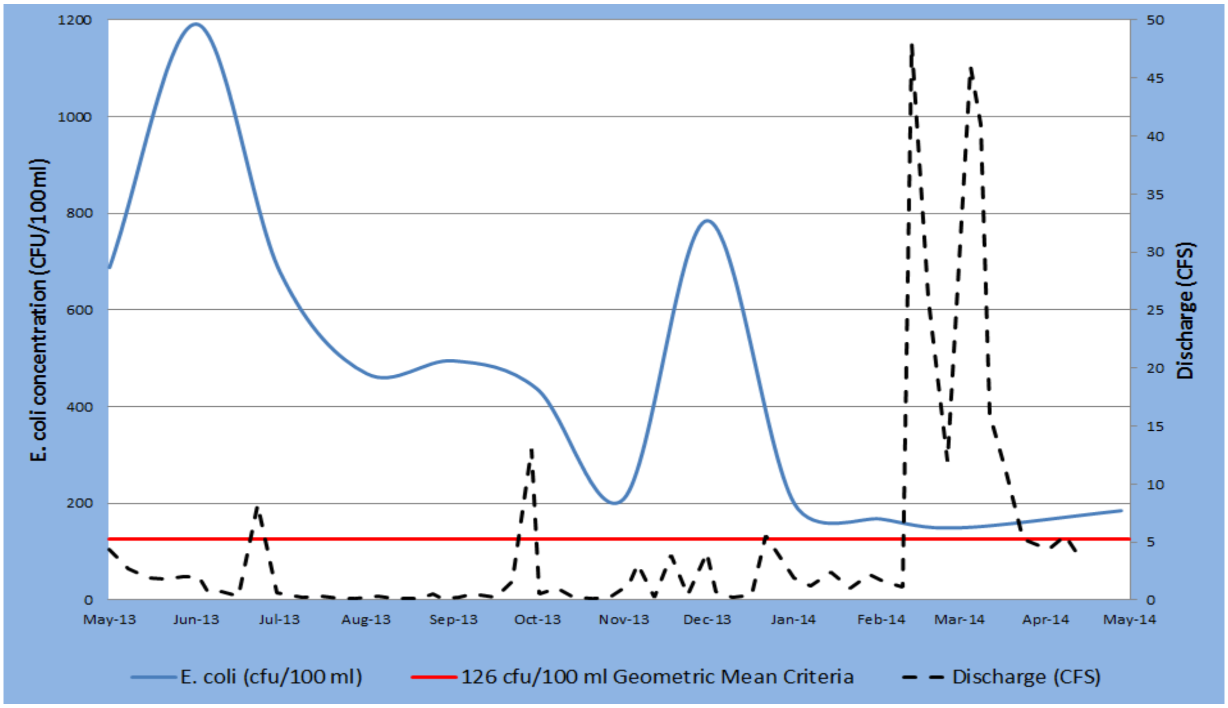

Figure 5. *E. coli* bacteria geometric mean concentrations with discharge data (in cubic feet per second) at Paradise Creek monitoring site (May 2013–April 2014).

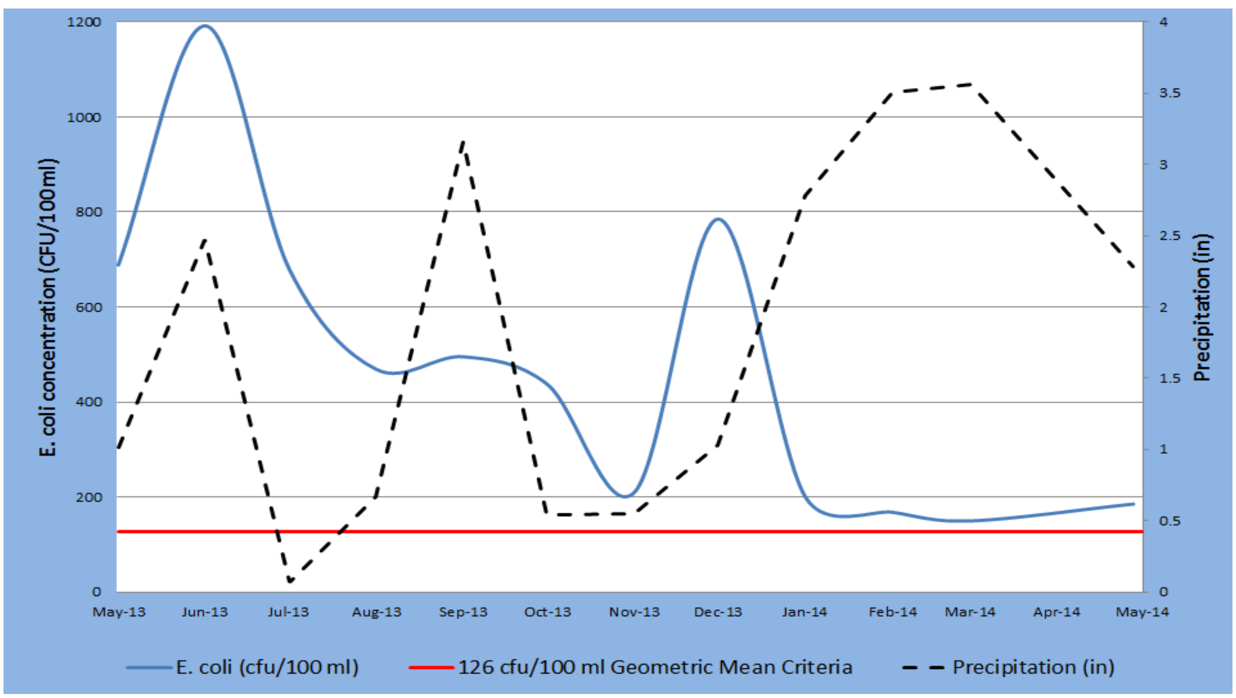

Figure 6. *E. coli* bacteria geometric mean concentrations with precipitation data (in inches) at Paradise Creek monitoring site (May 2013–April 2014).

2.3.1 Status of Beneficial Uses

Paradise Creek was previously listed as impaired for fecal coliform; *E. coli* is currently listed as the impairment due to a change in Idaho's water quality standards regarding contact recreation criteria from a criterion associated with fecal coliform to a more specific criterion for *E. coli*.

2.3.2 Assessment Unit Summary

A list of conclusions for the two AUs addressed in this report follows. This section includes changes that will be documented in the next Integrated Report once the TMDLs in this document have been approved by EPA.

ID17060108CL005_02, **Paradise Creek—urban boundary to Idaho/Washington border**

- Listed for fecal coliform.
- This AU is listed in Category 4a for approved TMDLs for fecal coliform.
- Data show the contact recreation bacteria standard is not met and load allocation is set in section 5 of this document.
- Keep in Category 4a; update impairment listing from fecal coliform to *E. coli*.

ID17060108CL005_02a, **Paradise Creek—forest habitat boundary to urban boundary**

- Listed for fecal coliform.
- This AU is listed in Category 4a for approved TMDLs for fecal coliform.
- Data show the contact recreation bacteria standard has the potential to be exceeded .The load allocation set in section 5 of this document for ID17060108CL005_02 is applicable to ID17060108CL005_02a when flows exceed 5 cubic feet per second (cfs).
- Keep in Category 4a; update impairment listing from fecal coliform to *E. coli*.

3 Subbasin Assessment—Pollutant Source Inventory

Since the Paradise Creek bacteria TMDL was approved by EPA in 1998, DEQ has collected bacteria data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent bacteria data.

Pollutants of concern for this addendum are limited to bacteria, for which the numeric criteria established in Idaho water quality standards have changed since the Paradise Creek TMDL was approved in 1998.

3.1 Point Sources

Current NPDES point sources permitted by EPA include the Moscow WWTP (ID-002149-1) and the University of Idaho Aquaculture Laboratory (ID-002715-4). Further information about applicable NPDES point sources can be found in the Paradise Creek TMDL (DEQ 1997) and in section 5 of this document. The history and current conditions of the Moscow WWTP are provided in section 4.1.2.

EPA published a new Multi Sector General Permit (MSGP) on September 29, 2008, to replace the 2000 MSGP. This permit covers industrial facility stormwater management in areas where EPA has NPDES authority. The 2008 MSGP applies to all new and existing facilities and requires that stormwater be controlled in accordance with terms and conditions of the permit. A permit search can be performed at *http://cfpub.epa.gov/npdes/stormwater/msgp.cfm*. An online database allows the public to view information about the MSGP entities under EPA's authority and can be accessed at *http://cfpub.epa.gov/npdes/stormwater/indust.cfm.* No facilities were identified in the Paradise Creek watershed. For more information about the MSGP and stormwater, see section 5.4.4.

3.2 Nonpoint Sources

The primary nonpoint sources for bacteria in the Paradise Creek watershed listed in the original TMDL were grazing lands, land development, and stormwater systems. A detailed discussion of nonpoint sources in the subbasin is provided in the Paradise Creek TMDL (DEQ 1997).

3.3 Pollutant Transport

Pollutant transport refers to the pathway by which pollutants move from the pollutant source to cause a problem or water quality violation in the receiving water body. *E. coli* is a living organism, and its transport and concentration in the water is influenced by many factors. Pollutant transport processes—including runoff, erosion, seepage, and direct impacts to the stream—could impact *E. coli* loads in Paradise Creek throughout the year.

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts

The *Paradise Creek Total Maximum Daily Load Implementation Plan* (Paradise Creek WAG 1999) outlined critical areas for project activity with input from stakeholders in the watershed and the Paradise Creek Watershed Advisory Group (WAG). Many watershed improvement projects with diverse funding sources have been completed or are ongoing in the Paradise Creek watershed. Local watershed management agencies have worked together and with private landowners to implement best management practices (BMPs) to help restore the watershed and prevent degradation.

Since the Paradise Creek TMDL was approved by EPA in 1998, many projects to directly improve water quality and instream habitat have been implemented in the Paradise Creek watershed. A summary of several of the restoration and improvement activities were provided by the University of Idaho, City of Moscow WWTP, and the Palouse-Clearwater Environmental Institute (PCEI) and are included below.

4.1 Restoration Activities

4.1.1 University of Idaho

Paradise Creek flows across the northern edge of the University of Idaho's main campus in Moscow. It enters campus on the east side just north of Sweet Avenue and flows across the entire campus to the Washington-Idaho border.

Property owners predating the university straightened and channelized the creek and constructed road and railroad crossings without adequate study or engineering to provide enough hydraulic capacity to properly convey flood events. In 1963 and 1965, the university covered approximately 1,300 linear feet of the creek. The result was that the creek was historically prone to flooding, with multiple inadequate undercrossings.

For the past 15 years, the university has been working to address this issue. An initial project was carried out in 1999–2000 in conjunction with the revitalization of the Sweet Avenue neighborhood on the east side of campus. A portion of that project restored a reach of Paradise Creek from Highway 95 to College Avenue. That project included creating large flood benches aimed at providing detention capacity to accommodate flood waters.

In 2010, the university completed a major restoration of Paradise Creek in collaboration with the US Army Corps of Engineers in the reach from Line Street to Perimeter Drive. This project featured a complete reconstruction of the channel from Line Street to Stadium Drive that diverted the main channel flow from under Paradise Creek Street. The project created a new undercrossing of Line Street in the form of a new, precast concrete deck bridge at Line Street that was engineered with enough hydraulic capacity to accommodate flow during a 500-year flood event. The 2010 restoration efforts were carried out in parallel with a project administered by the Division of Public Works that constructed two new undercrossings of Paradise Creek at Stadium Drive. The new bridges at Stadium Drive are cast-in-place concrete deck bridges engineered and designed to accommodate flow during a 500-year flood event.

To restore Paradise Creek, some 2,100 feet of new channel was constructed. The new channel alignment which is close to the historic channel of the creek, now runs along the east side of Line Street to Third Street, and then north and west adjacent to Idaho State Route 8 before merging with the original Paradise Creek channel. The new segment includes gentle channel meanders and riparian vegetation, improving the habitat and aesthetics of the creek and enhancing its ability to provide water quality treatment.

Future projects will include replacing the three parallel, corrugated culverts under Perimeter Drive with a structure with enough hydraulic capacity to accommodate flow during a 500-year flood event.

4.1.2 City of Moscow Wastewater Treatment Plant

Facility Description

The plant treats all wastewater collected from domestic, commercial, and institutional users within Moscow, including the University of Idaho. The majority of treated wastewater is discharged into Paradise Creek, a tributary of the South Fork Palouse River, under an NPDES permit. In addition to discharge to Paradise Creek, reclaimed treated effluent is used by the university for irrigation; an estimated 75 million gallons of treated effluent was diverted to the University of Idaho during the summer months for irrigation use.

History

The first Moscow WWTP was constructed in 1918 and consisted of two large septic tanks with contact beds for secondary treatment.

Trickling Filter Plant

A new WWTP was constructed in 1938 that included updating the contact beds to trickling filters and installing primary and secondary clarifiers and sludge digesters. The trickling filter plant was upgraded several times over the years, including the addition of new primary and secondary clarifiers, grit removal, and chlorination in 1957; effluent irrigation, prechlorination, and sludge disposal facilities in 1961; updates to chlorination and aeration in 1973; and installation of a sludge storage lagoon in 1976.

Phase I

Phase I upgrades were completed in 1996 and included the construction of sludge dewatering facilities as well as new chlorination and dechlorination buildings including a scrubber system in the event of a chlorine or sulfur dioxide leak.

Phase II

The plant headworks were upgraded in 1998 with the construction of a new headworks building and the installation of two Auger Monsters capable of grinding and screening the influent stream to remove rags, plastics, and large debris as well as a Pista grit system to remove inorganic, abrasive solids.

Phase III

In 1997, DEQ performed an assessment of Paradise Creek water quality that determined cold water aquatic life and secondary contact recreation to be the beneficial uses for the creek. Paradise Creek was listed as impaired for water quality, and a TMDL was prepared to quantify the various sources of pollutants and allocate the maximum load that can be discharged by each source in support of the beneficial uses. A more stringent NPDES permit was issued to the WWTP in 1999 that established discharge limits for ammonia, biochemical oxygen demand (BOD), chlorine, dissolved oxygen (DO), fecal coliform, pH, total phosphorus, total suspended solids (TSS), and flow/temperature.

To comply with the new permit limits, in 2002 the City of Moscow completed construction of an advanced secondary biological nutrient removal treatment plant. The new plant included an influent pump station, biological treatment system, two secondary clarifiers, re-aeration tank, chlorine contact chamber, utility water system, and sludge holding tanks. The new plant was quickly compliant with discharge limits for ammonia, BOD, chlorine, coliform, pH, and TSS.

Phase IV

To meet the phosphorus discharge limits set forth in the NPDES permit, the City of Moscow began constructing and installing tertiary filtration in fall 2008. Installation of five Parkson DynaSand filters was complete in October 2010. The system includes a continuous backwash, upflow, deep-bed granular media filter to remove phosphorus after coagulation with aluminum sulfate.

Phase V

During periods of warmer weather, the amount of discharge from the treatment plant to Paradise Creek is regulated under the NPDES permit. Allowable effluent discharge to the creek is calculated based on creek flow and temperature and the effluent temperature. The treatment plant has historically had difficulty in meeting the lower temperature discharge limits in the summer months. In 2010, preliminary planning for Phase V began to address this issue, with 17 potential alternatives being considered including reducing the temperature of the effluent through evaporative cooling towers, expanding wetland capability to reduce effluent temperature through evaporative transpiration, and expanding reuse options to reduce effluent discharge volume and increase effluent storage capacity so discharge to the creek could be delayed until cooler periods.

Current Treatment Configuration and Processes

Headworks

Preliminary treatment of raw wastewater occurs in the plant headworks and consists of grinding/screening to remove rags, plastics, and large debris and de-gritting to remove abrasives. Rags, plastics, and large debris pass through a grinder and are removed with a mechanical screen. The screenings are washed prior to removal and hauled off site for landfill disposal. Heavy inorganic materials such as sand and gravel are removed in the grit basin, thus protecting moving mechanical equipment from abrasive wear and minimizing the accumulation of these materials in basins. The settled grit is periodically pumped from the grit basin, further separated from organic matter, drained, and hauled off site for landfill disposal.

Influent Pump Station

The influent pump station consists of three constant speed enclosed screw (Archimedes) pumps. These run at a constant speed but can handle variable flow rates into the pump station. Each pump is rated at 7.0 million gallons per day and only one pump is required for routine operation. Influent is lifted by the screw pumps and delivered to the advanced secondary treatment system.

Treatment Basins

The advanced secondary treatment process consists of the conditioning tanks and the aeration basin. The biological nutrient removal system for the Moscow WWTP is designed to remove nitrogen and phosphorus from the wastewater in addition to traditional secondary treatment removal of BOD and TSS.

- Anaerobic Conditioning Basins (AA basins): Influent wastewater and return activated sludge are combined in the anaerobic basins. Operated under anaerobic conditions, the AA basins act as biological selectors for organisms with the ability to retain excess phosphorus for energy storage. The anaerobic tank mixture is discharged to the anoxic basins.
- Anoxic Basins (AO basins): Discharge from the AA basins enters the AO basins, where it is mixed with recirculated mixed liquor from the AA basins. The mixture undergoes anoxic conditions where nitrates and DO in the recirculated mixed liquor are consumed by the activated sludge biological organisms, but no new oxygen is added by aeration.

- Aeration Basin (AB basin): The AO basins discharge to the AB basin, where the mixed liquor is maintained in an aerobic state for BOD and ammonia removal and flocculation of suspended solids.

Clarification

Two 100-foot diameter final clarifiers provide a quiescent zone where biological solids from the aeration basin are settled out. The settled solids are either recycled back to the AA basin as return activated sludge or wasted from the system and sent to the sludge holding tanks as waste activated sludge.

Tertiary Filtration

Effluent filtration occurs through Parkson DynaSand filters that are operational during the WWTP phosphorus compliance season (May 15–October 15). The system includes a continuous backwash, upflow, deep-bed, granular media filter to remove phosphorus after coagulation with aluminum sulfate. Filtration may also be valuable in meeting requirements for expanding effluent reuse in the future.

Re-aeration

The re-aeration basin contains one constant speed floating surface aerator. Flow from the final clarifiers can be sent to the re-aeration basin depending on whether aerator operation is necessary to meet effluent DO discharge requirements.

Disinfection

To meet disinfection requirements, chlorine solution is injected into the flow stream at the head end of the chlorine contact chamber to allow adequate detention time for disinfection.

De-chlorination

Effluent de-chlorination is achieved by rapid reaction with sulfur dioxide gas injected into utility water and discharged into the effluent flow at the effluent weir.

Sludge Handling

The waste activated sludge is stored under aerobic conditions in the sludge storage tank(s). Two belt filter presses are used in sludge dewatering. The dewatered sludge is then hauled to Latah Sanitation for composting.

4.1.3 Palouse-Clearwater Environmental Institute

The PCEI is a nonprofit organization with programs that encourage sustainable living, provide experiential learning, and offer opportunities for serving in the community, while actively protecting and restoring natural resources. As part of PCEI's restoration work in the Paradise Creek watershed, over 42,691 linear feet of streambank has been restored, including 2,455,737 square feet of floodplain and 2,666,983 square feet of vegetated buffer. In addition, 54,211 herbaceous and woody plants have been planted; 139,702 square feet of wetlands have been created; and 2,541 feet of fencing has been installed through the efforts of PCEI and associated partners and volunteers.

The following restoration projects were funded in part by DEQ, EPA, the Idaho Bureau of Disaster Services, University of Idaho, and the City of Moscow with in kind match from organizations and individuals including the City of Moscow, University of Idaho, Washington State University, Americorps National Civilian Community Corps, TerraGraphics Environmental Engineers, Bon Terra, Nez Perce Soil and Water Conservation District, the Natural Resources Conservation Service, and community volunteers.

Carol Ryrie Brink Nature Park (1995–1996)

Paradise Creek had been straightened and channelized, creating unstable banks lacking riparian vegetation. The land adjacent to the stream was an active wheat field and plant diversity along the stream channel was low. The creek was heated by direct solar radiation. The water quality was impaired by direct, unbuffered flows of stormwater runoff.

During the project, the floodplain and streambanks were restored. A 5-acre floodplain was excavated and 1,200 feet of stream channel remeandered, moving 12,000 cubic yards of earth. Three 175-foot revetments for stabilization and demonstration purposes were built, including a log-crib revetment, a BioLog revetment, and a root-wad and rock revetment. Over 3,000 square feet of streambank and 5 acres of floodplain were seeded and mulched; over 6,000 square feet of geotextiles were installed, and over 750 native plants were planted.

Sweet Avenue Project (1998)

This section of Paradise Creek was channelized by previous landowners. In the past, this site was occupied by a concrete batch plant and a pesticide and diesel storage facility. Hazardous waste clean-up was conducted by the state. Eroding banks rose steeply on both sides.

First, channel meanders, a tighter low-flow channel, and a floodplain were constructed. The meanders provide more surface area for infiltration and more contact with riparian plants, which improve water quality and create better wildlife habitat. The reconstructed low-flow channel, sized for 2-year flows, increases base flow during the hot summer months, which also benefits aquatic life. The riparian floodplain was built to contain a 500-year flood event and provide water storage during heavy storm events. The floodplain was planted with native riparian vegetation, which acts as a buffer. Water quality is improved as suspended sediment and associated pollutants are settled out on the floodplain during flood events. Hydraulic modeling showed that the constructed two-stage flood channel would not cause a rise in 100-year flood elevations. In fact, the modeling showed a drop in localized flood elevations of up to 1.5 feet.

Secondly, streambanks were resloped and sculpted for stabilization purposes, then covered with geotextile fabric to prevent erosion. Some of the streambanks were terraced and geotextile fabric applied in a stairstep fashion to form soil wraps. Redosier dogwoods were planted between the soil wraps to provide future bank stabilization with their root systems, and 20-foot coconut fiber BioLogs were interlocked to line the stream course to prevent bank erosion. The entire area was hydroseeded with grass and planted with native woody vegetation. These plants, in addition to their future aesthetic and erosion control value, will provide cooling shade to the stream and thereby decrease water temperature and increase the amount of DO available to fish and other aquatic organisms. In addition, this vegetation acts as a food and cover source for a diversity of wildlife, including songbirds, amphibians, and mammals.

The Sweet Avenue project also included construction of biofilters including grassy swales and "pocket" wetlands. These swales, or biofilters, are structural BMPs designed to treat stormwater runoff from the adjacent parking lot. The "pocket" wetlands were built in the bank of the existing stream channel and currently treat stormwater runoff as well as water flowing into Paradise Creek during higher flow events.

Chipman Trail (1999–2000)

This reach of Paradise Creek was characterized by weedy banks, devoid of woody vegetation. The channel was dredged in the past, and is wide, with steep, vertical banks. To stabilize the banks, native willow poles were planted along the stream. In addition, over 2,000 native trees and shrubs were planted in approximately 40-foot wide buffer strips on either side of the creek. These will grow to shade the stream, helping moderate stream temperatures. Woody riparian buffers offer many benefits, including filtration of runoff, wildlife habitat, and floodwater retention. The City of Moscow Parks Department also cooperated with PCEI to plant native trees along the Chipman Trail, which parallels the project site, to expand the buffer width on the north side of the stream to approximately 75 feet.

Mountain View Park (1999–2000)

The 900-foot segment of the creek that flows through Mountain View Park is impacted by heavy pedestrian use. Activities such as soccer, baseball, and dog walking are typical park uses; consequently, the stream channel has few significant meanders due to this intensely managed landscape. Lack of significant vegetation allowed direct flow of stormwater runoff containing pollution to the creek. Reed canary grass is the dominant cover type, providing little shade to the creek channel. Canopy cover was minimal along this segment of the creek.

Volunteer groups helped plant 1,100 trees and shrubs along the tops of the streambanks. In spring 2000, 600 plants were planted and in the fall of the same year an additional 500 plants were planted at this site. These plantings will create a riparian forest buffer along the creek, which improves water quality, wildlife habitat, and aesthetics.

Meadow Street Projects (2000)

The stream channel was being impacted by the surrounding urban development and past land use practices. The riparian area was degraded due to water flow barriers such as concrete walls, chunks of concrete in the creek, and the steep gravel embankment along Meadow Street before the bridge across Joseph Street. Reed canary grass was the dominant cover type. These conditions significantly affected the stability of the inner streambank. Undercutting and bank failure was a common result.

The 65-foot project on the Lorfing property, located on the east side of the creek along Meadow Street, was manually constructed. The streambank was resloped and stabilized. A bundle of redosier dogwood cuttings was placed along the toe of the bank, vertical bundles of redosier dogwood were installed in shallow trenches running from the creek up the bank, and preplanted coconut fiber BioLogs were tiered along the toe of the bank for stabilization during the higher winter and spring flows. The entire area was seeded with a native riparian grass seed mix and then covered with erosion control fabric.

The second phase of this project included a 300-foot stream segment where an excavator removed a leaning concrete wall and the fill material associated with it. Then a two-tier floodplain was created along the length of the project. Over 50 live redosier dogwood poles were planted. The exposed streambanks were seeded with a native riparian grass seed mix, which was covered by erosion control fabric.

Nichols Project (2000)

The western side of Paradise Creek on this property was severely eroded and was slumping down into the creek. The streambanks were frequently undercut during heavy storm events. The area of concern along the western streambank was approximately 60 feet long. Restoration activity occurred from the creek edge to approximately 9 feet up the west streambank. BioLogs were installed to secure the toe of the slope. The site was also planted with native vegetation and willow poles to assist in securing the banks.

Berman Creekside Park (2001)

A tree-revetment was installed at the west end of the park, on the south bank of Paradise Creek. Plantings were done along the north streambank, where Paradise Creek passes through the park. At the location of the tree-revetment, the stream segment had near-vertical, slumping, eroding streambanks that were frequently undercut by high water events, contributing to the sediment load in the creek. There were also areas of steep, exposed banks eroding due to a lack of vegetative cover.

The purpose of the tree-revetment was to stabilize and revegetate a 150-foot section of eroding streambank to reduce the amount of sediment entering the stream and provide habitat for fish and wildlife. A cedar/fir revetment was constructed, which involved securing 18 fallen trees along the base of the outside bank with cables and posts. Once that was completed, the upper bank was sloped back and covered with erosion control fabric, and native woody vegetation was planted. Plantings were also done on the north side of Paradise Creek to stabilize the bank and add plant diversity to the riparian zone.

State Line Project (2001)

Streambanks along this segment of Paradise Creek were eroding due to a lack of woody vegetation and the steepness of the banks. The streambanks were frequently undercut during heavy storm events. The main purpose of this project was to stabilize and revegetate a 1,020-foot section of stream to provide habitat for fish and wildlife, provide shade to reduce stream temperatures, provide a vegetated buffer from agricultural runoff, and reduce the amount of sediments entering the stream. Earth moving was completed by University of Idaho Farm Operations. PCEI staff, volunteers, and the AmeriCorps National Civilian Community Corps team completed the other bank stabilization activities.

The steep streambanks were resloped to either a 2:1 slope (in areas where space was limited due to the proximity of a road) or to a 3:1 slope (where space was not limited). These more gradual slopes reduce erosion, reconnect the stream to its floodplain, and create an area in which to plant native vegetation. The resloped banks were seeded with a riparian grass mixture and covered with geotextile fabric. Native woody vegetation was planted in the fall. Where feasible, concrete that was dumped in or along the stream channel was also removed. The removal of concrete will allow for vegetation to be planted along the stream to provide habitat for fish and wildlife. In selected areas, coconut fiber BioLogs, preplanted with wetland plants, were installed along the toe of the streambank to stabilize the bank.

Bridge Street Park & West Bridge Street Bank Stabilization (2001–2002)

These stream segments were typified by slumping, eroding streambanks that were frequently undercut during heavy storm events, contributing sediment to Paradise Creek. In addition, annual dredging artificially widened and incised the stream channel. Few trees or woody vegetation grew along the stream segment.

The purpose of the Bridge Street Park project was to reconfigure approximately 450 linear feet of a straight, ditch-like creek to a low-flow channel with a terraced floodplain. Approximately 390 cubic yards of soil were excavated from this site. The newly constructed low-flow channel has a 3- to 4-foot bottom width, compared to the old width of 8 feet, and conveys the 1.5- to 2-year flow. Approximately 195 of the 390 cubic yards of soil were used as backfill to create the two-tiered floodplain with soil wraps to increase the flood storage capacity of this reach. The remaining 200 cubic yards of soil were removed off site. The local 10-year flood elevation was decreased by a maximum of 0.2 feet, and the 100-year flood elevation was decreased by 0.1 feet upstream of the project. Geotextile fabric soil wraps were used and seeded with native grasses. Each soil wrap is about 6 feet wide and 1 foot high. To create the terraces, the excavator constructed soil wraps out of erosion control blankets and some of the excavated material and secured them in place. The floodplain was constructed to a width of 20 feet on the west side of the stream in Bridge Street Park. In fall 2001, woody shrubs and trees were planted along the bank to introduce shade to the stream.

An additional 100-foot stream segment was stabilized just downstream of the Bridge Street Park project. The steep streambanks were resloped to reduce the sediment entering the stream. Erosion control blankets and coconut fiber-filled BioLogs preplanted with wetland plants were installed along the streambanks to stabilize the toe of the slope and to help improve water quality by reducing nutrients through the water-filtering qualities of wetland plants.

4.2 Water Quality Monitoring

Continued monitoring will determine the effectiveness of current and future BMP implementation. Continuing to reduce nonpoint pollutant sources will be a priority in the Paradise Creek watershed with continued monitoring to assess beneficial use support in the watershed.

DEQ will assess water quality status during development of the biennial Integrated Report and 5-year TMDL review processes. Based on input from the Palouse WAG, additional data to help determine pollutant inputs were collected in AUs ID17060108CL005_02a and ID17060108CL005_02 in October 2014. AU ID17060108CL005_02a is considered intermittent, and flow did not exceed the optimum flow of 5 cfs, so numeric water quality standards do not apply. Additional data were collected at four sites in the watershed: Darby Road in AU ID17060108CL005_02a and Mountain View Park, Heron’s Hideout Park, and near the USGS gage station on Perimeter Drive in AU ID17060108CL005_02. These data can be seen in Appendix C. DEQ will continue to collect water quality data to determine beneficial use support.

5 Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from known sources to ensure water quality standards are met. It further allocates this load capacity among the various known sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates.

This TMDL is written to provide specific wasteload allocations to known NPDES-permitted point sources and assigns a gross load allocation to nonpoint sources in the watershed.

5.1 Instream Water Quality Targets

Waters designated for primary or secondary contact recreation are not to contain *E. coli* bacteria in concentrations exceeding a geometric mean of 126 cfu/100 mL based on a minimum of five samples taken every 3–7 days over a 30-day period (IDAPA 58.01.02.251.01.a). See Appendix A for further discussion of water quality standards.

Paradise Creek is designated for secondary contact recreation. The load capacity used to establish the instream target and allocations for Paradise Creek is based on the Idaho geometric mean criterion of 126 cfu/100 mL for *E. coli* bacteria.

5.1.1 Design Conditions

Bacteria are living organisms with an associated die-off rate, which fluctuates with varying water quality and atmospheric conditions (EPA 2001). Flow, temperature, and suspended sediment, along with other factors associated with the water body, dictate the actual mass of bacteria present in the water column and complicate the allocation process because of the continuous and constant fluctuation of these factors that occur during any given time period (Mehaffey et al. 2005). To simplify this process, the daily allocation is expressed as 126 cfu/100 mL, the target geometric mean concentration currently allowed by Idaho's water quality standards. There is no critical time period for *E. coli* bacteria in Paradise Creek for the purposes of this TMDL since the allocation applies year-round. AU ID17060108CL005_02a is also flow dependent because it is considered intermittent and criteria only apply when flow is equal to or greater than 5 cfs.

Nonpoint source monitoring for *E. coli* was conducted at a control point located downstream from the USGS Paradise Creek gage station and upstream from the City of Moscow WWTP in order to evaluate nonpoint source loading.

The City of Moscow WWTP and the University of Idaho Aquaculture Laboratory are the two NPDES-permitted point sources in the watershed identified in the 1997 Paradise Creek TMDL. Both were excluded from the monitoring design because both facilities collect bacterial effluent and monitoring data as established in their NPDES permits and are considered appropriate for evaluation of point source loading in this assessment. Load allocations and wasteload allocations associated with the Paradise Creek watershed are discussed further in section 5.4.

5.1.2 Target Selection

Instream water quality targets were selected based on the numeric water quality criterion for *E. coli* bacteria that applies to water bodies designated for contact recreation. Waters designated for contact recreation are not to contain *E. coli* bacteria, used as indicators of human pathogens, in concentrations exceeding the geometric mean criterion of 126 cfu/100 mL based on a minimum of five samples taken every 3–7 days over a 30-day period (IDAPA 58.01.02.251.01.a).

5.1.3 Water Quality Monitoring Points

Monitoring for *E. coli* bacteria for nonpoint sources was conducted at a site located on Paradise Creek that captured the headwater, agricultural, and urban impacts to the water body. The site is at the intersection of Paradise Creek with Perimeter Drive in Moscow, Idaho, located in AU ID17060108CL005_02 at latitude 46.73194 and longitude -117.02479, downstream from the Paradise Creek USGS gage station (Figure 7). This site is an urbanized area after the creek has passed through the City of Moscow and the University of Idaho campus. The monitoring site characterizes the three AUs at a single discharge point and was sampled from May 2013 through April 2014.

Based on input from the Palouse WAG, additional data to help determine pollutant inputs were collected in AUs ID17060108CL005_02a and ID17060108CL005_02 in October 2014. AU ID17060108CL005_02a is considered intermittent and flow did not exceed the optimum flow of 5 cfs, so numeric water quality standards would not apply. Data were collected at four sites in the watershed: Darby Road in AU ID17060108CL005_02a and Mountain View Park, Heron's Hideout Park, and near the USGS gage station on Perimeter Drive in AU ID17060108CL005_02. These data can be seen in Appendix C.

The City of Moscow WWTP discharge monitoring reports were used to evaluate point source loads.

Figure 7. Paradise Creek monitoring site.

5.2 Load Capacity

The *E. coli* bacteria load capacity for Paradise Creek is a geometric mean of 126 cfu/100 mL. The load capacity is expressed as a concentration (cfu/100 mL) because the calculation of mass load is difficult due to the variability of temperature, moisture conditions, and flow, which can all influence the die-off rate of *E. coli* bacteria in the environment (EPA 2001).

The load capacity (LC) can also be expressed as an equation, with flow as the variable:

$$E.\ coli\ \text{LC (in } 10^9 \text{ cfu/day)} = Q\ (cfs) \times 3.08 \times 10^9\ cfu/day/cfs$$

Where Q is the flow of the creek **measured in cfs**.

The coefficients are simply a collection of conversion constants:

E. coli: $126\ cfu/100\ mL \times \frac{86400\ s/day \times 28.3\ L/cf}{0.1\ L/100\ mL \times 10^9} = \mathbf{3.08} \times 10^9\ cfu/day/cfs$

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)).

Potential nonpoint *E. coli* bacteria sources to Paradise Creek are waste from humans, pets, livestock, and wildlife. The individual percent load contribution from each nonpoint source cannot be determined from available data.

The current point source within the Paradise Creek watershed is the City of Moscow WWTP. The University of Idaho Aquaculture Laboratory was given a wasteload allocation in the 1997 Paradise Creek TMDL and an NPDES permit; however, it was determined that the aquaculture facility was not contributing a bacterial load to Paradise Creek.

5.4 Load and Wasteload Allocation

Bacteria are living organisms, and varying water quality and atmospheric conditions, which fluctuate continuously, dictate the actual mass of bacteria in the water. This fluctuation can complicate the load allocation process. For the purpose of this TMDL, *E. coli* loads are based on a bacteria concentration of 126 cfu/100 mL, collected as a 5-sample geometric mean over 30 days, the geometric mean concentration currently allowed by Idaho's water quality standards.

Table 5 lists the existing *E. coli* monthly geometric mean bacteria concentrations calculated from measurements at the monitoring site in the lower reaches of the Paradise Creek watershed from May 2013 through April 2014. The table also shows the load reduction needed to comply with the 126 cfu/100 mL criterion.

The *E. coli* bacteria TMDL for Paradise Creek allocates a daily concentration to all nonpoint sources of *E. coli* bacteria upstream from the sample site. The load allocation (LA) calculated here is based on the flow of water from nonpoint sources. These flows are highly variable, so a flow-variable equation is used. *Water quality managers should focus on the concentration targets.*

E. coli LA (in 10^9 cfu/day) = $Q\ (cfs) \times 3.08 \times 10^9\ cfu/day/cfs$

Where Q is the flow of the creek **measured in cfs**. Again, the coefficients are simply a collection of conversion constants, identical to those explained in section 5.2. If the flows increase, the load allocation correspondingly increases, according to the equation above.

LAs for range of flows.

flow (cfs)	LA (cfu/day)
1	3.08.E+09
5	1.54.E+10
10	3.08.E+10
20	6.16.E+10
30	9.24.E+10
40	1.23.E+11
50	1.54.E+11

As such, sources extending upstream from this location must be managed to reduce the instream *E. coli* bacteria concentrations in accordance with the load reductions set forth in Table 5. To ensure the criterion is not exceeded, this allocation will apply daily throughout the year.

For AU ID17060108CL005_02, data show that this AU is perennial and contact recreation bacteria conditions are not being met; therefore, a year-round load allocation is set. AU ID17060108CL005_02a has shown potential to exceed the geometric mean criterion but is considered intermittent and so load allocations apply when flows exceed 5 cfs (IDAPA 58.01.02.070.06).

Table 5. *E. coli* bacteria concentrations and necessary reductions in Paradise Creek.

Date	Existing Conc.[a] (cfu/100 mL)[b]	Daily Conc. Target[a] (cfu/100 mL)[b]	Conc. Reduction (cfu/100 mL)[b]	Necessary Reduction (%)
May 2013	688.1	126	562.1	82
June 2013	1192.0	126	1066.0	89
August/September 2013	485.7	126	359.7	74
October 2013	437.0	126	311.0	71
November 2013	209.3	126	83.3	40
December 2013	785.1	126	659.1	84
January 2014	200.2	126	74.2	37
February 2014	167.9	126	41.9	25
March 2014	149.6	126	23.6	16
April 2014	185.1	126	59.1	32

[a] As a geometric mean concentration [b] Colony-forming units per 100 milliliters of solution

The *E. coli* wasteload allocations are based on a bacteria concentration of 126 cfu/100 mL, the geometric mean concentration currently allowed by Idaho's water quality standards. This TMDL is concentration based, so the wasteload allocation (WLA) is based on the design flow.

E. coli WLA (in 10^9 cfu/day) = $Q \times 4.76$

Where Q is the design flow of the facility **in million gallons per day** (mgd).

The coefficients are simply a collection of conversion constants:

$$E.\ coli\text{: } 126\ cfu/100\ mL \times \frac{3.785\ L/gal \times 10^6\ gal/million\ gal}{0.1L/100mL \times 10^9} = \mathbf{4.76} \times 10^9 cfu/\ day/mgd$$

If the design flow were to increase, then the wasteload allocation would correspondingly increase, according to the equations above.

The NPDES permits associated with the two permitted point sources identified in the 1997 Paradise Creek TMDL have not been reissued with limits reflecting Idaho's current water quality standards for *E. coli*. Therefore, the permit limits given to the two point sources (Table 6) are still in terms of fecal coliform. The wasteload allocation of 126 cfu/100 mL for *E. coli* bacteria should be applied in future permit cycles.

Table 6. Current wasteload allocations for point sources in the Paradise Creek watershed.

Facility/Source	NPDES[a] Permit Number	Average Monthly Limit (colonies/100 mL)	Average Weekly Limit (colonies/100 mL)	Maximum Daily Limit (colonies/100 mL)
City of Moscow wastewater treatment plant	ID-0021491	100	200	800
University of Idaho	ID-0027154	100	200	—

[a] National Pollutant Discharge Elimination System

The City of Moscow WWTP has bacterial effluent and monitoring requirements set forth in its NPDES permit. The NPDES permit requires monitoring for fecal coliform rather than *E. coli* bacteria. The WWTP discharge monitoring reports show that the plant is meeting its fecal coliform effluent requirements and no reduction in its wasteload allocation is required as long as fecal coliform effluent limits are met. The City of Moscow WWTP NPDES Annual Report of Progress for the 2013 reporting period reported that the average for fecal coliforms for 2013 was 5.43 cfu/100 mL, with a maximum of 82 cfu/100 mL (City of Moscow WWTP 2013). Figure 8, taken from the annual report, shows the NPDES permit limits and effluent fecal coliform levels for 2013.

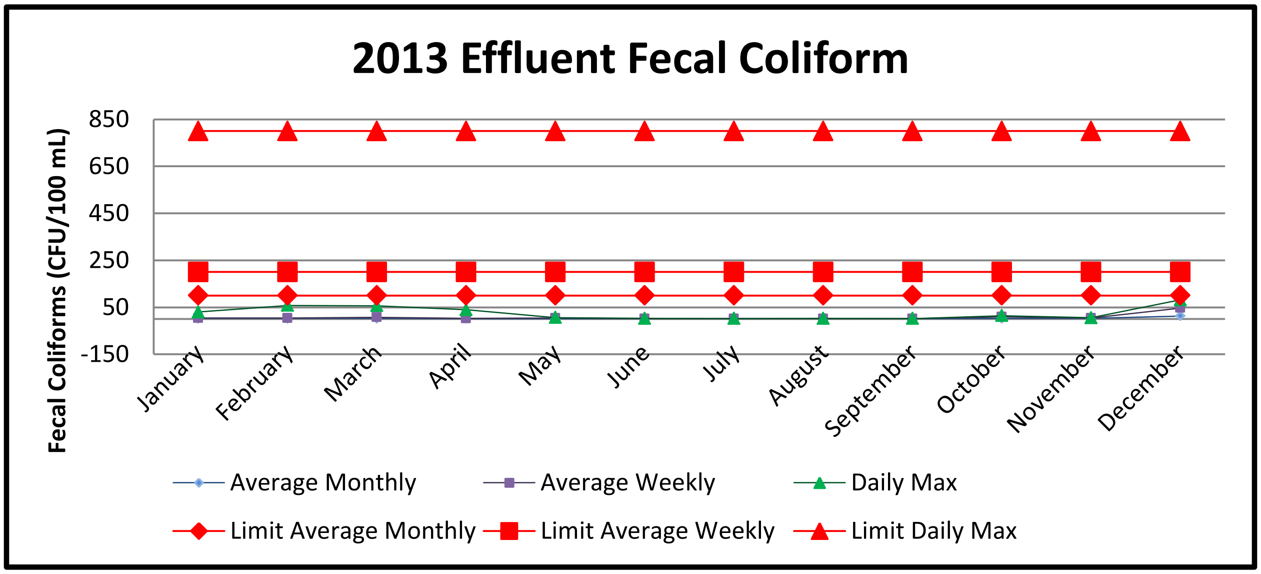

Figure 8. Moscow WWTP 2013 effluent fecal coliforms. (*Source*: City of Moscow WWTP 2013)

The University of Idaho Aquaculture Laboratory has effluent and monitoring requirements set in its NPDES permit, and no reduction of its wasteload allocation is required as long as the laboratory is meeting its fecal coliform effluent limits. The University of Idaho Aquaculture Laboratory has not discharged effluent since May 2, 2007, but outflow rates fluctuate depending on the current research direction (Scott Williams, Facility Manager, University of Idaho Aquaculture Laboratory, personal communication). The University of Idaho Aquaculture Laboratory does not need an *E. coli* effluent limit or load allocation, therefore none will be provided in this addendum.

5.4.1 Margin of Safety

In the case of *E. coli*, the pollutant load capacity has been calculated for the most critical time periods identified and is applied year-round. Existing loads are based on recent data and the geometric mean. The margin of safety for the point and nonpoint sources is provided using recent data and the geometric mean. The load capacity of the effluent is the wasteload allocation for the point sources. The application of the conservative geometric mean criteria methods for TMDL calculations provide an implicit MOS.

5.4.2 Seasonal Variation

E. coli bacteria data collected from May 2013 through April 2014 do not suggest a seasonal trend at the monitoring site. During the 2013–2014 year-long monitoring effort, 60 samples were taken. Geometric means were calculated for each month (except July) and all were above the 126 cfu/100 mL criterion (Table 4). Data are presented in their entirety in Appendix B.

5.4.3 Reasonable Assurance

Although the impaired watershed has two point sources of *E. coli*, these sources discharge at a concentration lower than the water quality criteria. In other words, the point sources are reducing the *E. coli* concentrations with their discharge. The only way to reduce *E. coli* levels to meet the water quality criteria is to reduce the pollution from nonpoint sources. There must be reasonable assurance that these reductions will be implemented and effective in achieving the water quality target.

CWA §319 requires each state to develop and submit a nonpoint source management plan. The *Idaho Nonpoint Source Management Plan* was approved by EPA in March 2015 (DEQ 2015). The plan identifies programs to achieve implementation of nonpoint source best management practices (BMPs), includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, including basin advisory groups and WAGs. The Palouse Subbasin Watershed Advisory Group (WAG) is the designated WAG for the Palouse subbasin.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 7.

Table 7. State of Idaho's regulatory authority for nonpoint pollution sources.

Authority	Water Quality Standard	Responsible Agency
Rules Pertaining to the Idaho Forest Practices Act (IDAPA 20.02.01)	58.01.02.350.03(a)	Idaho Department of Lands
Solid Waste Management Rules and Standards (IDAPA 58.01.06)	58.01.02.350.03(b)	Idaho Department of Environmental Quality

Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03)	58.01.02.350.03(c)	Idaho Department of Environmental Quality
Stream channel Alteration Rules (IDAPA 37.03.07)	58.01.02.350.03(d)	Idaho Department of Water Resources
Rathdrum Prairie Sewage Disposal Regulations (Panhandle District Health Department)	58.01.02.350.03(e)	Idaho Department of Environmental Quality/Panhandle District Health Department
Rules Governing Exploration, Surface Mining and Closure of Cyanidation Facilities (IDAPA 20.03.02)	58.01.02.350.03(f)	Idaho Department of Lands
Dredge and Placer Mining Operations in Idaho (IDAPA 20.03.01)	58.01.02.350.03(g)	Idaho Department of Lands
Rules Governing Dairy Waste (IDAPA 02.04.14)	58.01.02.350.03(h)	Idaho State Department of Agriculture

Idaho uses a voluntary approach to address agricultural nonpoint sources; however, regulatory authority is found in the water quality standards (IDAPA 58.01.02.350.01–03). IDAPA 58.01.02.055.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan) (SCC and DEQ 2003), which provides direction to the agricultural community regarding approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (soil conservation districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, the Ag Plan assigns the local soil conservation districts to assist the landowner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The Idaho water quality standards and wastewater treatment requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; Idaho Soil and Water Conservation Commission for grazing and agricultural activities, Idaho Transportation Department for public road construction, Idaho State Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.010.24).

5.4.4 Construction Stormwater and TMDL Wasteload Allocations

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the MSGP, and construction stormwater covered under the Construction General Permit (CGP).

5.4.4.1 Municipal Separate Storm Sewer Systems

Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies. An MS4, according to 40 CFR 122.26(b)(8), is a conveyance or system of conveyances that meets the following criteria:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the United States
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
- Not a combined sewer
- Not part of a publicly owned treatment works (sewage treatment plant)

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program, and use BMPs to control pollutants in stormwater discharges to the maximum extent practicable.

5.4.4.2 Industrial Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body.

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an industrial facility discharges industrial stormwater into waters of the United States, the facility must be permitted under EPA's most recent MSGP. To obtain an MSGP, the facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors.

TMDL Industrial Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations.

5.4.4.3 Construction Stormwater

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

Construction General Permit and Stormwater Pollution Prevention Plans

If a construction project disturbs more than 1 acre of land (or is part of a larger common development that will disturb more than 1 acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

TMDL Construction Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a gross wasteload allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric wasteload allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

Postconstruction Stormwater Management

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and*

Counties (DEQ 2005) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing in order to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

5.4.5 Reserve for Growth

An explicit growth reserve has not been included in this TMDL addendum. The load capacity has been allocated to the existing sources in the watershed. Any new sources will need to obtain an allocation from the existing load allocation. The TMDL is based on a target *concentration*. Therefore, growth can occur provided the following are true:

- The receiving stream channel can transport the extra effluent.
- The effluent contains an *E. coli* concentration less than 126 cfu/100 mL (30-day geometric mean)

DEQ and this addendum make no statement about water rights or availability.

5.5 Implementation Strategies

Please see the *Paradise Creek TMDL: Water Body Assessment and Total Maximum Daily Load* (DEQ 1997) and the *Paradise Creek Total Maximum Daily Load Implementation Plan* (Paradise Creek WAG 1999) for a complete list of designated management agencies and associated implementation efforts.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals.

5.5.1 Pollutant Trading

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Pollutant trading is recognized in Idaho’s water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ’s *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2010).

5.5.1.1 Trading Components

The major components of pollutant trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Ratios are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database by DEQ or its designated party.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant beyond a level set by a TMDL:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the wasteload allocation.
- Nonpoint sources create credits by implementing approved BMPs that reduce the amount of pollutant runoff. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP; apply discounts to credits generated, if required; and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit) is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

5.5.1.2 Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL are protected. To do this, hydrologically based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

5.5.1.3 Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ’s pollutant trading guidance (DEQ 2010).

6 Conclusions

Effective *E. coli* bacteria targets were established for Paradise Creek based on the Idaho water quality standards surface water quality criterion for recreation use designations (Appendix A). The existing *E. coli* bacteria load was determined from surface water sampling that took place from May 2013 through April 2014 (Appendix B). Target and existing *E. coli* bacteria levels were compared to determine the reduction needed to bring water bodies into compliance with *E. coli* bacteria criteria (IDAPA 58.01.02.251.01.a). A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table 8.

Table 8. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Paradise Creek—urban boundary to Idaho/Washington border	ID17060108CL005_02	*E. coli*	Yes	No changes, currently in Category 4a	Update from fecal coliform to *E. coli* standard
Paradise Creek—forest habitat boundary to urban boundary	ID17060108CL005_02a	*E. coli*	Yes	No changes, currently in Category 4a	Update from fecal coliform to *E. coli* standard

This document was prepared with input from the public, as described in Appendix E. This appendix also includes public comments and DEQ responses. A distribution list is included in Appendix F.

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GIS Coverages

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Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

Water Quality Standards

State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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Appendix A. Surface Water Quality Criteria for Recreation Use Designations (IDAPA 58.01.02.251)

01. ***E. Coli*** **Bacteria**. Waters designated for recreation are not to contain *E.coli* bacteria, used as indicators of human pathogens, in concentrations exceeding:

a. Geometric Mean Criterion. Waters designated for primary or secondary contact recreation are not to contain *E. coli* bacteria in concentrations exceeding a geometric mean of one hundred twenty-six (126) *E. coli* organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to seven (7) days over a thirty (30) day period.

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Appendix B. Paradise Creek Monitoring Data

Table B1. Paradise Creek *E. coli* data, AU ID17060108CL005_02.

Date	Sample Results (cfu/100 mL)	Continuous Geometric Mean (cfu/100 mL)	Monthly Geometric Mean (cfu/100 mL)	Discharge (cfs)
5/02/2013	263.5			4.4
5/09/2013	529			2.7
5/16/2013	189.1			1.9
5/22/2013	>2419.2			1.8
5/28/2013	>2419.2	688.1	**688.1**	2.0
6/03/2013	517.95	787.7		2.0
6/06/2013	>2419.2	1067.6		0.72
6/11/2013	328.15	1192.0		0.72
6/17/2013	>2419.2	1192.0		0.36
6/24/2013	>2419.2	1192.0	**1192.0**	8.2
7/01/2013	246.15	1027.2		0.64
7/10/2013	479.05	743.0		0.22
7/17/2013	>2419.2	1107.9		0.36
7/24/2013	548.3	823.4		0.14
7/29/2013	923.4	679.1		0.14
8/06/2013	394.7	746.4		0.31
8/12/2013	290.9	675.5		0.14
8/21/2013	264.6	433.9		0.14
8/26/2013	>2419.2	583.9		0.56
8/29/2013	307.6	468.7		0.14
9/04/2013	156.8	389.6		0.22
9/09/2013	875.3	485.7	**485.7**	0.49
9/17/2013	426.9	534.4		0.26
9/23/2013	728.4	420.4		1.6
9/30/2013	697.9	495.2		13
10/03/2013	89.7	442.9		0.56
10/09/2013	411	380.7		1.0
10/15/2013	237.8	338.7		0.22
10/22/2013	751.6	340.8		0.18
10/28/2013	>2419.2	437.0	**437.0**	0.22
11/04/2013	638.8	647.2		1.3
11/07/2013	431	653.3		3.1
11/13/2013	44.7	467.7		0.26
11/19/2013	>2419.2	590.9		3.9
11/25/2013	13.5	209.3	**209.3**	0.42
12/02/2013	>2419.2	273.2		4.1

Date	Sample Results (cfu/100 mL)	Continuous Geometric Mean (cfu/100 mL)	Monthly Geometric Mean (cfu/100 mL)	Discharge (cfs)
12/05/2013	291.5	252.7		0.72
12/11/2013	>2419.2	561.3		0.26
12/18/2013	816.4	451.7		0.42
12/23/2013	214.2	785.1	**785.1**	5.6
1/02/2014	24.6	313.6		1.9
1/08/2014	1179.2	414.7		1.2
1/15/2014	77.7	208.5		2.4
1/22/2014	378.9	178.8		1.0
1/29/2014	376.4	200.2	**200.2**	2.2
2/03/2014	197	303.5		1.6
2/10/2014	36	151.0		1.1
2/13/2014	579.4	225.7		48
2/19/2014	248.9	207.5		26
2/26/2014	130.4	167.9	**167.9**	12
3/06/2014	160.3	161.1		46
3/10/2014	97.7	196.7		41
3/13/2014	535.9	193.7		16
3/19/2014	64.7	147.9		11
3/25/2014	137.8	149.6	**149.6**	5.3
4/03/2014	62.1	123.7		4.4
4/09/2014	1209.8	204.6		5.6
4/15/2014	100.9	146.5		3.4
4/21/2014	179.5	179.7		N/A
4/28/2014	159.5	185.1	**185.1**	3.4

Notes: milliliter (mL); colony-forming unit (cfu); cubic foot per second (cfs)

Appendix C. Additional October 2014 Monitoring Data

Site Name	10/1/14	10/7/14	10/14/14	10/20/14	10/23/14	Monthly Geometric Mean (cfu/100 mL)
Darby Road	11	1	3	1	1	2.0
Mountain View Park	218.7	5.8	1	1	108.1	10.7
Heron's Hideout Park	275.5	27.5	93.9	613.1	24.6	101.4
Perimeter Drive	1203.3	39.3	114.5	32.3	1413.6	189.9

Note: colony-forming unit per 100 milliliters (cfu/100 mL)

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Appendix D. Data Sources

Table D1. Data sources for Paradise Creek subbasin assessment and TMDL.

Water Body	Data Source	Type of Data	Collection Date
Paradise Creek	DEQ Lewiston Regional Office	*E. coli* bacteria	May 2013 through April 2014
Paradise Creek	USGS Gage Station #13346800	Flow	May 2013 through April 2014

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Appendix E. Public Participation and Public Comments

This TMDL addendum was developed with participation from Palouse Subbasin Watershed Advisory Group (WAG).

The Palouse Subbasin WAG voted to provide a 30-day public comment period for a public comment draft of the Paradise Creek TMDL bacteria addendum during the December 2014 WAG meeting. Notice was provided to the general public through the *Moscow-Pullman Daily News* and the DEQ website of the opportunity to comment from January 16, 2015, through February 17, 2015.

Copies of the document were made available through the DEQ Lewiston Regional Office and were available for download on the website.

The comments received were reviewed and discussed by the WAG during the September 2015 meeting. The WAG provided the agency advice on the following responses and actions to the comments received.

Written comments were received from:

- US Environmental Protection Agency
  Region 10, Idaho Operations Office
  Boise, Idaho
- State of Washington
  Department of Ecology
  Spokane, Washington

Comments received are addressed below.

US Environmental Protection Agency
Comment 1:
There is no effort in this document to identify sources of E. coli bacteria in Paradise Creek. It is important to attempt to identify the source of the pollution in order to develop a workable implementation plan to reduce contamination in the stream.

Response: This information is more appropriate for the implementation plan. The purpose of this addendum is to establish that there was a need for an *Escherichia coli* (*E. coli*) TMDL in the watershed. During the implementation process, the watershed advisory group (WAG) and designated management agencies (DMAs) will work together to determine sources of bacterial contamination and steps to reduce the nonpoint source impacts to Paradise Creek.

Comment 2:
On page 11, section 3 titled Subbasin Assessment – Pollutant source inventory, there is a short description of what a point source and a nonpoint source is but really nothing in the way of a source inventory. This section could be expanded.

Response: The 1998 Paradise Creek TMDL includes a detailed pollutant source inventory and discussion of nonpoint pollutant sources in the subbasin.

Comment 3:
Information in the document seems to indicate that the Moscow Waste Water Treatment Plant is meeting water quality standards for bacteria and the University of Idaho Aquaculture Laboratory is meeting its effluent limits. I am not sure why the U of I Aquaculture lab is included in this allocation because fish do not have fecal coliform or E. Coli bacteria.

Response: The University of Idaho Aquaculture Facility was given a fecal coliform wasteload allocation in the 1998 TMDL and has a limit in the NPDES permit for the facility. The University of Idaho Aquaculture Laboratory does not need a bacteria wasteload allocation; therefore none will be assigned. The TMDL has been revised accordingly.

Comment 4:
Since the point sources do not appear to be a problem for bacteria, the nonpoint sources would seem to be the issue. I don’t see any change in the amounts of bacteria in the stream since the 1996 TMDL. A more specific look at NPS sources would seem to be useful in reducing the bacteria load in this stream.

Response: The 1998 Paradise Creek TMDL includes a detailed pollutant source inventory and discussion of nonpoint pollutant sources in the subbasin. During the implementation planning process, the designated management agencies will create a plan to assess and address sources of bacterial pollution in the watershed.

Comment 5:
In looking at the data in Appendix B, I count at least 10 sample results given simply as >2419.2 cfu. I believe that means that these results are greater than 2419.2 cfu but I have no idea how much greater. It seems to me that if this is the number used to calculate the geometric mean it would inherently under estimate the true geo mean. It also makes me think there are some serious sources of bacteria in the watershed that need to be assessed.

Response: The upper detections limit of the Quanti-Tray/2000 method is 2419.2 cfu/100 mL. Results could be higher than 2419.2 cfu/100 mL but for the purposes of this addendum using the upper limit provided by the Quanti-Tray/2000 method demonstrates the need for an *E. coli* TMDL.

Comment 6:
Are there any failing septic drainfields in the watershed that could be affecting the bacteria concentration? Was this type of source investigated? Concentrated animal feeding operations?

Response: During the implementation planning process, the designated management agencies will create a plan to assess and address sources of bacterial pollution in the watershed. Please see the 1998 Paradise Creek TMDL for a detailed discussion of nonpoint pollutant sources in the subbasin.

Washington Department of Ecology

Comment 7:

The Implementation Plan which will follow this TMDL would benefit if the TMDL drew some conclusions about potential sources from the data. For example, the bacteria loading for each sample date could be calculated from the data in Appendix B. If the loading stays the same throughout the year or for certain time periods it may indicate a consistent source of contamination. However, if the loading varies seasonally or with precipitation, it would suggest runoff sources are the primary concerns. Similar conclusions could be drawn from Figures 5 and 6.

Response: The purpose of this addendum is to prepare an *E. coli* TMDL for the Idaho portion of Paradise Creek. During the implementation planning process, the designated management agencies will create a plan to assess and address sources of bacterial pollution in the watershed.

Comment 8:

The Idaho TMDL should reference the Washington TMDL. Even though the Washington TMDL addresses fecal coliform bacteria, relative comparisons between its findings and the *Idaho E.* coli data can be made. The Washington TMDL also included a monitoring site at Perimeter Road in Idaho and it included one at the state line. Reductions needed at the Idaho TMDL site are relevantly consistent with those needed in Washington's TMDL.

Washington's TMDL divides the year into a dry-season and wet-season. The TMDL found that during the dry-season average dry-season loading originated in Idaho with 77% of the loading occurring between the Perimeter Road site and the state line site. The wet season load in this same reach was generally of the same order of magnitude suggesting it could be from a continuous source or sources. Locating and correcting sources in this reach could significantly improve the water quality of Paradise Creek in Washington.

Response: The purpose of this addendum is to prepare an *E. coli* TMDL for the Idaho portion of Paradise Creek. Both Idaho and Washington states' water quality standards are approved by the EPA for adequacy in protecting recreational beneficial uses. Therefore, by meeting Idaho's criteria Paradise Creek should be meeting Washington's fecal coliform criteria as *E. coli* is part of the group of fecal coliforms. Any reduction of *E. coli* in the watershed would reduce downstream impacts, including the section of stream below Perimeter Drive to the state line.

Comment 9:

Page 1, Introduction, 1st paragraph, 2nd sentence

It states that the purpose of the TMDL addendum "is to document pollutant loads within the Paradise Creek watershed." This statement should be clarified that the purpose also includes allocating the stream's carrying capacity among the various sources to reduce the loads to meet water quality standards.

Response: This TMDL has 126 organisms per 100 mL water gross allocation for all nonpoint sources and 126 organisms per 100 mL water allocation for all known, permitted point sources in the watershed. The state standard is used as the carrying capacity of the stream and the 126 organisms per 100 mL water standard is applied to all point and nonpoint sources in the watershed. The second paragraph in the introduction addresses more specifically this comment.

Comment 10:
Page 5, Section 2.2

This section should also address the requirements under the Clean Water Act that TMDLs must be established at levels so as to not impact downstream state's or tribe's water quality standards.

Response: A section has been added, 2.2.4 Interstate Waters, to address this comment.

Comment 11:
Page 28, Section 5.4.3.1

EPA issued a [preliminary] draft NPDES permit for the City of Moscow in 2011 that has not yet been finalized. However, based on the assumption it will be finalized and issued to the City, this TMDL should include wasteload allocations or implementation activities to incorporate into a future permit to address bacteria loading from stormwater.

Response: Stormwater load allocations have been addressed in section 5.4.3. For *E. coli*, there is a numeric limit set forth in Idaho state standards for contact recreation, a geometric mean of 126 organisms per 100 mL water. In order to meet these standards, Paradise Creek needs to meet the geometric mean of 126 organisms per 100 mL water standard throughout the watershed. For the purpose of this TMDL, an allocated load of a geometric mean of 126 organisms per 100 mL water will be the limit whether stormwater is considered a permitted point source or a nonpoint source.

Comment 12:
Page 28, Section 5.4.3.2

The language under "Industrial Stormwater Requirements" appears to be generic. Are there any industrial facilities regulated under a stormwater permit within the TMDL boundary? If so they should be specified and permit actions or wasteload allocations incorporated. IDEQ may also want to consider including wasteload allocations or permit actions for any future industrial facilities that may come under NPDES coverage.

Response: There are no industrial facilities of concern within the Paradise Creek watershed that are currently regulated under a stormwater permit.

Comment 13:
Page 30, Section 5.5, 2nd paragraph

It has been approximately 18 years since the original fecal coliform TMDL was established. This section should describe in what ways the implementation strategies will be modified to move Paradise creek toward the TMDL goals established in the original TMDL and in this TMDL.

Response: During the implementation planning process, the designated management agencies will create a plan to assess and address sources of bacterial pollution in the watershed which will include an evaluation of the previous implementation plan and what needs to be modified to move Paradise Creek toward meeting the load allocations set forth in the TMDL addendum.

Appendix F. Distribution List

Clearwater Basin Advisory Group

Palouse Subbasin Watershed Advisory Group

Department of Environmental Quality- State Office

Department of Environmental Quality - Lewiston Regional Office

US Environmental Protection Agency, Idaho Operations Office

Washington Department of Ecology

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